

Hiroshi HARA*: On the Asiatic species of the genus *Panax*

原 寛*: アジア産トチバニンジン属**

(Plates X—XII)

My observations on the Asiatic races of the genus *Panax* were summarized in my Flora of Eastern Himalaya 641-643 (1966). In 1968, R.N. Banerjee published a revision of Indian *Panax*, but to my regret, his paper was inadequate based only on herbarium specimens, and was misleading in many respects. I feel that it is significant to present in detail my data so far obtained in the field as well as in the herbaria.

The Himalayan plants In 1966, I pointed out that it is essential to interpret *Panax pseudo-ginseng* Wallich (1829) correctly. This species was precisely described and illustrated by Wallich (1829 & 31), and at Kew, I have examined its type specimen collected by Wallich at Sheopore of Nepal in 1821. Fortunately in June of 1969, the 4th Botanical Expedition to Eastern Himalaya by University of Tokyo had a chance to observe this race on Mt. Shioupuri (at about 2500 m above the sea-level) near Kathmandu of Nepal which exactly agrees with the Wallich's plant. This locality seems to be the same as the type locality, and the race forms a separate colony from that of the other race which also occurs on the same mountain.

Typical *Panax pseudo-ginseng* (Pl. X, a & b) is characterized in having fleshy carrot-like roots which are sometimes fascicled, very short rhizomes, obovate—obovate-oblong (2.5-4.5 cm wide) leaflets which are long caudate-acuminate at the apex, doubly incise-serrate with cuspidate close teeth on the margin, and copiously bristly (setae up to 2 mm long) on nerves only on the upper surface, stipule-like appendages at the base of petioles, slender smooth pedicels, inconspicuous bracts, subtriangular calyx-lobes, and larger flattish seeds (Fig. 2, a).

It is striking that this race was proved to have $2n=24$ chromosomes by

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Miss Sachiko Kurosawa (Pl. X, c). This chromosome number is the new lowest one in *Panax**, but some others from Darjeeling and the Singalila Range have also $2n=24$ chromosomes (unpublished). The pollen grains of typical *P. pseudo-ginseng* from Shiopouri were kindly examined by Miss Chizu Chuma, and they are $22-24 \times 25 \mu$ in size, with very fine reticulation on the surface.

The common Himalayan plants (subsp. *himalaicus*), however, have generally long creeping rhizomes, although their shape is variable by individual. The mode of rhizomes in the genus *Panax* can be roughly divided into three main types. Type A is represented by typical *P. pseudo-ginseng* (Pl. X, b). Type B has long horizontally creeping rhizomes with short and thick inter-

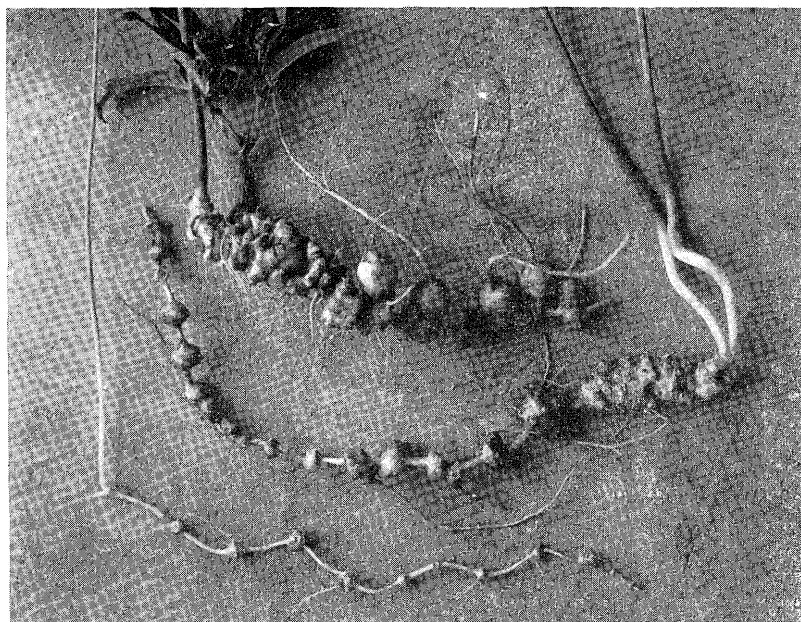


Fig. 1. Rhizomes of *Panax pseudo-ginseng* subsp. *himalaicus*, collected at Sandakphu, the Singalila Range, Jul. 14, 1969.

* In Darlington and others, Chromosome Atlas of Flowering Plants (1945 & 55), 24 is given as the somatic number for *Panax fruticosum* and *P. japonicum*. However, *P. fruticosum* L. is now regarded as the type species of a separate genus *Nothopanax*. And for *P. japonicum*, Matsuura and Suto (1935) reported the gametic number in PMC as 24, and it was misquoted as the somatic number by Darlington.

nodes (Pl. XI, a), as commonly observed in the Japanese plants. In Type C, the internodes are elongate and slender with thick subglobose nodes, as shown in Pl. XI, e. Pl. XI, c-e and Fig. 1 show a variation in rhizomes within one population collected in a subalpine forest at Sandakphu (at 3900 m high) of the Singalila Range in middle July of 1969. It is evident that the shape of rhizomes is changeable not only by individual in the same population but also varies to some extent due to ecophysiological conditions even in the same individual which lives more than twenty years. Pl. XI, c & d, and Fig. 1 show a transition from Type C to B of the rhizomes in the same individual.

It is to be noted that the plants growing at the higher elevations tend to have slender nodulose rhizomes (Type C), and under more favourable ecological and nutritious conditions the rhizomes probably become thicker. In all cases, a fleshy tuberous root is produced at the first period of life, but that root is often decayed or detached in the older plants.

Banerjee considered persistent scales at the base of the stem as an important character for his new species, *P. sikkimensis*, but the scales are also persistent in typical *P. pseudo-ginseng*, as already pointed out by C. B. Clarke in 1879. They are present at first in all races of *Panax*, but the degree of their persistence is unstable.

At the base of the petioles, the stipule-like appendages are present in typical *P. pseudo-ginseng*, but they are also found in var. *notoginseng* of Yunnan, and the specimens from Tonkin (cf. p. 203). This character seems to be stable in one population, but not to correlate with other characters.

In this group, it has long been known that the shape of the leaflets including the serrature, the density and length of bristles on leaves, the shape of leaf-base, and the length of petiolules are very variable. The plants which agree with typical *P. pseudo-ginseng* in all characters of the leaflets are very rare. But taking the shape of leaflets alone, some Chinese or even some Japanese plants are similar to the typical plants of *P. pseudo-ginseng*. On the other hand, some Nepalese specimens are less bristly and agree with the Chinese and Japanese ones in this respect.

Within the same population, the characters of the leaflets are fairly stable, but are often different from one population to another, and they seem not to show any distinct correlation with other characters such as rhizomes and flowers.

Even in Eastern Himalaya, the plants (Pl. XII, a) have generally somewhat narrower leaflets as compared with typical *P. pseudo-ginseng*. Especially var. *angustifolia* (Pl. XII, b) described from Sikkim, Bhutan, and Khasia by Burkill (1902) has narrower lanceolate (less than 2.5 cm wide) leaflets with small and close teeth on the margin.

It is strange that Banerjee (1968) reduced var. *angustifolia* to *P. pseudo-ginseng*, quoting only 'the common characters' from Burkill's description and ignored the differentiating characters which were correctly pointed out by Burkill. Moreover, it is inconceivable that Banerjee published two new species, *P. sikkimensis* and *P. assamicus*, based on similar characters to those of var. *angustifolia* and from the same regions as those of var. *angustifolia*.

The number and the length of the pedicels is also unstable, and the pedicels are mostly minutely scabrous. But typical *P. pseudo-ginseng* has smooth slender pedicels, and the specimens from Chapa of Tonkin have also almost smooth pedicels.

The bracts at the base of pedicels vary in shape, from ovate to lanceolate or linear, and up to 2-2.5 mm long. They are generally prominent in the Japanese plants, but often inconspicuous especially in the Himalayan plants.

The calyx-lobes are variable from ovate-triangular to depressed triangular, and sometimes roundish and flat. They are mostly uniform in shape in one population, but the correlation with other characters is not clear.

The flowers are generally hermaphrodite or male, and both kinds of flowers are on different individuals, or often even mixed in a single umbel. The shape and size of the calyx-tube, disk, style, and anther are subject to variation strongly effected by the sexuality of the flower. In hermaphrodite flowers, 2 styles are free and often recurved, or united in the lower part, and sometimes the styles are 3 or 4. In a specimen from Yunnan (T. T. Yü, no. 12413, in A), the number of the styles vary from 2 up to 5. But in male flowers, the calyx-tube is small, and the styles are 2 and short, or often united to their tip in a single column. The petals are oblong or ovate, 2-2.5 mm long, and deciduous. The anthers are oblong (about 1.5 mm long when young), elliptic or oval (about 1 mm long).

The fruits contain generally 2 or 3 seeds, and those with two seeds are cocoon-shape, and slightly flattened. The seeds are mostly subglobose, 4.5-5 mm long and 3-4 mm thick (Fig. 2, b). The ripe fruits are bright red, and

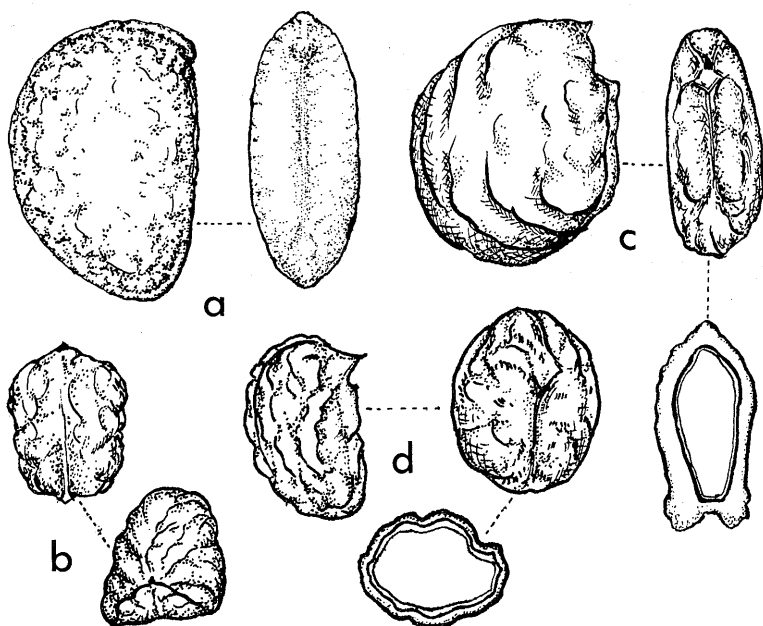


Fig. 2. Seeds. $\times 5$. a. *Panax pseudo-ginseng* subsp. *pseudo-ginseng*. b. *P. pseudo-ginseng* subsp. *himalaicus*. c. *P. Ginseng*. d. *P. pseudo-ginseng* subsp. *japonicus*.

black in the apical portion, but sometimes wholly red without a black top.

The breeding system in the genus *Panax* has not been well studied. The plants are polygamo-dioecious or polygamo-monoecious, and are generally considered to be pollinated by insects. The hermaphrodite and male flowers are often in a single individual, sometimes with male side-umbels, or even in a single umbel, outer flowers being male. The number of individuals in one population is generally small, and they are usually uniform in the nature of leaves, pedicels, and calyx-lobes. These facts suggest that the individuals in one population are propagated by branching of the rhizomes, or by inbreeding, sometimes pollinated from different flowers of the same individual.

On the other hand, a few individuals are growing in wild habitats isolated from other ones, and they have often some characters different from those of the other ones, or some intermediate characters between the neighbouring populations. These facts show that outbreeding also occurs occasionally.

As explained above, the Asiatic plants of the group are very variable in many characters, and we have to be careful to select differentiating characters among the Asiatic races, although some extreme forms look very different. By any single character, the Asiatic races cannot be separated from one another. At the same time, it is also evident that the range of morphological variations is not quite the same in different geographical regions.

For example, every form of rhizomes and roots is found in the Himalayan plants and also in the Chinese ones. But the Japanese plants show mostly the rhizomes of Type B. The shape of leaflets is also most variable in

Himalaya and West China, but much less in Japan.

In having pinnatifid leaflets with incise-serate lobes (Fig. 3), *P. bipinnatifidus* looks very different from others, and occurs generally at the higher altitudes in Eastern Himalaya, and West and Central China. But, as pointed out by Li (1942), intermediate forms (Fig. 4) are frequently found especially where this race is growing mixed with *P. pseudo-ginseng* subsp. *himalaicus*. The rhizomes are nodulose with slender internodes (Type C), so far as I have examined. Excepting the shape of leaflets this race cannot be distinguished from

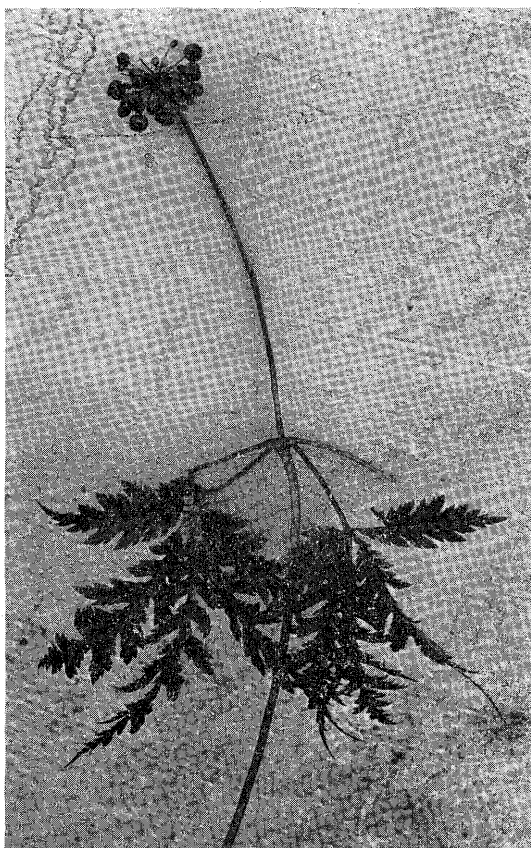


Fig. 3. *Panax pseudo-ginseng* var. *bipinnatifidus*, collected at Tonglu, the Singalila Range, Jul. 21, 1969.

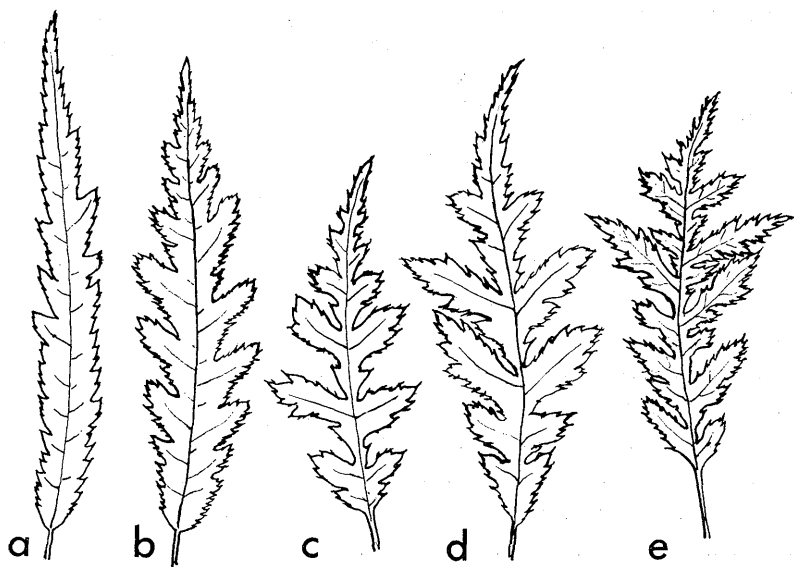


Fig. 4. Leaflets of *P. pseudo-ginseng* var. *bipinnatifidus*. $\times 1$. a. Sandakphu, the Singalila Range, 3800 m. b. Phalut-Sandakphu, 3700 m. c. Dochu La, Bhutan, 2800 m. d-e. Above Bakkim, Sikkim, 2300 m.

other races of subsp. *bipinnatifidus* in any essential characters. It is proper to regard this race as a variety of *P. pseudo-ginseng*.

The specimens collected near Chapa of Tonkin (Pételot, no. 2489, Apr. 1935, A, TI) have stipule-like projections at the base of petioles, and smooth pedicels as in typical *P. pseudo-ginseng*, but differ from the latter in having thick creeping rhizomes, more elongate leaflets which are less deeply serrate on the margin and less bristly, many lanceolate bracts, and flat roundish calyx-lobes.

Ginseng Among these polymorphic Asiatic races, the most distinct race is *P. Ginseng*. It has long been cultivated for medicinal use in China, Korea, and Japan, and its tuberous roots are one of the most well-known and highly esteemed Chinese drugs called 'Ginseng'. The rhizomes do not develop, and the roots are carrot-like, and sometimes fascicled or forked. The leaflets are obovate-elliptic, shortly acuminate at the apex, glabrescent or sparsely bristly on nerves, and less sharply serrate on the margin. The fruits are larger and laterally flattened, and the seeds are also larger and flattened (5-

6 mm long, 4–5 mm wide, and 2–2.5 mm thick) (Fig. 2, c). The pollen grains are $26\text{--}28 \times 29\text{--}31 \mu$ in size, and coarser reticulate on the surface. The somatic chromosome number is 44 (Sugiura 1936; Graham 1966), or 48 (Imamura 1936; Harn & Whang 1963).

Prof. S. Shibata, Assoc. Prof. O. Tanaka, and their collaborators of Department of Pharmaceutical Sciences, University of Tokyo, have worked in detail on saponins and sapogenins contained in rhizomes and roots of the genus *Panax*¹⁾. According to their studies, roots and rhizomes of *P. Ginseng* as well as *P. quinquefolius* of North America contain sapogenins consisting of a large quantity of dammarane-type triterpenes (20S-protopanaxadiol and 20S-protopanaxatriol), and a small quantity of oleanane-type triterpene (oleanolic acid). These dammarane-type saponins are considered to be the main effective chemical constituents of *Panax*.

On the other hand, all Himalayan and Japanese races contain sapogenins consisting of a very large quantity of oleanane-type triterpene and only a very small quantity of dammarane-type triterpenes. And slight differences were observed in quantity of dammarane-type sapogenins by race. The Japanese race contains a small quantity of dammaranes, while typical *P. pseudo-ginseng* from Shioupuri of Nepal has only a trace of it.

P. Ginseng is rather uniform, and is known in the wild only in a limited area of North Korea, S. & E. Manchuria, and Ussuri. Taking these facts into consideration, it seems better to treat *P. Ginseng* as an independent species from *P. pseudo-ginseng*.

The Chinese plants As already noted by Burkill in 1902, the Chinese plants are also very variable. Excepting *P. Ginseng*, Li (1942) referred all other Chinese plants to *P. pseudo-ginseng*, while P'ei and Chou (1958) recognized 4 species from China, i.e. *P. bipinnatifidus*, *P. major*, *P. japonicus*, and *P. pseudo-ginseng*. In rhizome, leaflet, flower, and fruit, some Chinese specimens are indistinguishable from the Japanese ones, and some others show various intermediate forms between the Himalayan and Japanese ones. Var. *major* (Henry, no. 5396c, K, E, NY, TI) from Hupeh of C. China has large broad leaflets with a shorter acuminate tip, short teeth, and only a few

1) Ando, T., Nagai, Y., Tanaka, O. and Shibata, S. 1970. Saponins and sapogenins of various species of *Panax*. Jap. Journ. Pharmacog. 24 (in press).

setae along the nerves on the upper surface. The plants corresponding to var. *major* are not uncommon in Japan, and such Chinese ones with thick creeping rhizomes as Patung, Hupeh (Wilson, no. 1208 in K) agree well with the Japanese ones in all respects. Even Henry's specimens cited under var. *major* Burkill vary in the shape of rhizomes. This form seems to pass gradually into *P. pseudo-ginseng* subsp. *himalaicus* with narrower more bristly leaflets with deeper cuspidate teeth and a longer cuspidate apex, and slender nodulose rhizomes through various intermediate forms.

Aralia quinquefolia var. *notoginseng* Burkill was described based on several specimens at Kew collected from the mountains lying 50 miles south-east of Mengtze in SE. Yunnan by Henry, but they are not uniform. Henry regarded them to be the original plant of 'San-chi', which name should primarily be applied to another famous drug only cultivated in the Kwangsi-Yunnan districts. So I wish to select the specimen (Henry no. 11407A in K) noted as 'cultivated San-chi' by Henry as the lectotype of var. *notoginseng*. The specimen (Henry no. 11407 in NY) is also the same. These specimens have somewhat obovate 3-7 leaflets which are abruptly acuminate at the apex, shortly serrate, longer petiolulate, and are bristly on nerves as in *P. pseudo-ginseng*, stipule-like appendages, dense umbels with many bracts and very numerous pedicels, and subglobose seeds, but unfortunately lack the lower part of stems and rhizomes. Other specimens (Henry no. 11407 in K) remarked as 'wild near plantations of the drug' are considered to be escaped from cultivation by the collector, but have larger leaflets with a longer caudate apex, less bristly, and thick creeping rhizomes (1-1.2 cm across) as in *P. japonicus*. The specimen (Szemae, Henry no. 12259 in K) has similar leaflets to those of typical *P. pseudo-ginseng*, but the other (Henry no. 12259A in K) has leaflets near to typical var. *notoginseng*, and thick creeping rhizomes (7-10 mm across). It is very doubtful if 'San-chi' sold at the market at present is the rhizomes of var. *notoginseng* of South China, and it seems to include other races or even *P. Ginseng*.

Whereas some specimens from Yunnan (for example, T. T. Yü, no. 12413, A, and C. W. Wang, no. 63975, TI) have oblanceolate leaflets which are 1.5-3 cm wide and coarsely serrate, and slender nodulose rhizomes (Type C). Var. *elegantior* Burkill from Hupeh has oblanceolate leaflets similar to those of var. *angustatus* of Japan, but has slender nodulose rhizomes.

The Japanese plants The Japanese plants have been considered generally as an independent species, *P. japonicus* C. A. Meyer. They tend to have thick creeping rhizomes (Type B), elliptic to obovate (3-7 cm wide) and glabrescent or sparsely bristly leaflets which are acuminate at the apex and irregularly serrate with shorter-pointed teeth, minutely scabrous pedicels 4-17 mm long, small numerous bracts, ovoid seeds (Fig. 2, d), and pollen grains with very fine reticulation on the surface. The chromosome number is $2n=48$ (Matsuura & Suto 1935; Kurosawa 1966).

But the Japanese plants are also considerably variable, and the differences from the Himalayan and Chinese plants are not always distinct. The rhizomes of the Japanese plants rarely have elongate internodes but not so conspicuous as in Type C, and on the other hand, the rhizomes of Type B are occasionally found in the Himalayan and Chinese plants.

As compared with typical *P. pseudo-ginseng*, the leaflets are shorter acuminate at the apex, less bristly, and less cuspidately serrate. But in the density of bristles, some Nepalese specimens are the same as some Japanese ones, and in the shape of leaflets some Japanese specimens from Western Honshu and Shikoku have doubly incise-serrate leaflets (*f. incisus* (Nakai)) as in typical *P. pseudo-ginseng*.

One of the Japanese races (var. *angustatus*) with narrower oblong-lanceolate leaflets which are 6-13 cm long, 1.5-3 cm wide, and attenuate at the base to a short petiolule occurs in the Tokai District of Honshu, Shikoku and Kyushu. In the shape of the leaflets, it resembles var. *elegantior* of Hupeh, but the latter has slender nodulose rhizomes (Type C). Var. *angustifolius* of Himalaya has narrower leaflets which are caudately long-acuminate at the apex, more closely and sharply serrate, more bristly, sometimes roundish at the base, and longer petiolulate.

In the Japanese plants, the number of leaflets is 4-7, but rarely 8 or 3 (*f. trifoliolatus*). The length of the petiolules is also variable. The calyxlobes are triangular and acute at the apex, or roundish. The styles are 1-3 (4), and 0.8-2.2 mm long. The mature fruits are bright red and mostly black around the top (*f. dichrocarpus*), but sometimes wholly red, and very rarely yellow (*f. xanthocarpus*).

Considering these variability, it is difficult to separate the Japanese plants specifically from the Himalayan ones, and I wish to treat the Japanese plants

as a geographical subspecies of *P. pseudo-ginseng*.

The results of my studies are summarized as follows:

Key to the Asiatic races

- 1 {
 - Roots carrot-like sometimes forked (Type A), with a very short rhizome. Seeds larger flattish, 5-8 mm long and 2-2.5 mm thick. Leaflets obovate to obovate-oblong..... 2
 - Rhizomes long creeping (Type B or C). Seeds smaller ovoid, 4-5 mm long and 3-4 mm thick. 3
- 2 {
 - Leaflets shortly acuminate at the apex, shortly serrate, glabrescent. Pedicels scabrous. Pollen grains coarser reticulate. *P. Ginseng*
 - Leaflets caudate acuminate, doubly sharply serrate, often conspicuously bristly. Pedicels slender smooth. Stipule-like appendages at the base of petioles. Pollen grains very finely reticulate. *P. pseudo-ginseng* subsp. *pseudo-ginseng*
- 3 {
 - Leaflets pinnatifid, with incised or sharply serrate lobes. *P. pseudo-ginseng* var. *bipinnatifidus*
 - Leaflets incise-serrate or serrate 4
- 4 {
 - Leaflets narrower lanceolate (up to 2.5 cm wide), more uniformly serrate, with close small teeth, and sometimes roundish at the base. var. *angustifolius*
 - Leaflets broader, irregularly doubly serrate..... 5
- 5 {
 - Leaflets longer caudate-acuminate at the apex, with cuspidate sharp teeth, and densely or sparsely bristly. Rhizomes usually slender and nodulose (Type C). Bracts often inconspicuous.subsp. *himalaicus*
 - Leaflets shorter acuminate at the apex, with shorter cuspidate teeth, and glabrescent or sparsely bristly. Rhizomes usually thick (Type B). Bracts generally numerous.subsp. *japonicus*

Panax Ginseng C. A. Meyer in Rep. Pharm. Prakt. Chem. Russ. 7: 524 (1842); in Bull. Phys.-Math. Acad. St.-Pétersb. 1: 340 (1843)—Seemann in Journ. Bot. 2: 320 (1864); 6: 54 (1868)—Komarov, Fl. Mansh. 3: 126 (1905)—Jzushritzky, Zhenshen 58 (1961)—Hara, Fl. E. Himal. 642 (1966). (Fig. 2, c).

P. quinquefolia a. *coreensis* Siebold, Syn. Pl. Oecon. Jap. 45 (1830), nom. nud.

P. Schin-seng Nees, Icon. Pl. Medic. 5: t. 16 A—A3, d-f (1833), nom.

superfl., cum var. (1) *coraiensis* Nees (excl. var. 2 & 3)—Makino in Journ. Jap. Bot. 1(5): (128), fig. (1917)—Nakai in Journ. Arn. Arb. 5: 35 (1924), cum f. *spontaneum* et f. *cultum* Nakai—Li in Sargentia 2: 116 (1942)—Fl. URSS 17: 34, t. 2, f. 4 (1950)—Hara, Enum. Spermat. Jap. 3: 290 (1954)—P'ei et Chou, Icon. Chin. Med. Pl. 6: f. 283 (1958)—Ohwi, Fl. Jap. ed. Engl. 663 (1965); ed. rev. 962 (1965).

P. quinquefolium var. *Ginseng* (Mey.) Regel et Maack ex Regel, Tent. Fl. Ussur. 72 (1861); in Gartenfl. 11: 314, t. 375 (1862).

Aralia Ginseng (Mey.) Baillon, Hist. Pl. 7: 152 (1880).

A. quinquefolia var. *Ginseng* (Mey.) Regel et Maack in Kew Bull. 1892: 107 (1892), comb. nud.—Makino in Bot. Mag. Tokyo 8: (225) (1894)—Burkill in Kew Bull. 1902: 6 (1902).

Distr. North Korea, S. & E. Manchuria, and Ussuri; cultivated in China, Korea, and Japan.

Panax pseudo-ginseng Wallich in Trans. Med. Phys. Soc. Calcutta 4: 117 (1829); Pl. Asia. Rar. 2: 30, t. 137 (1831)—Meyer, l.c. 340 (1843)—Seemann, l.c. 54 (1868)—Merrill in Journ. Arn. Arb. 23: 187 (1942)—Li, l.c. 117 (1942)—Jzushritsky, l.c. 50 (1961)—Hara, Fl. E. Himal. 227 & 641, f. 58 (1966)—Banerjee in Bull. Bot. Surv. Ind. 10: 23 (1968).

P. Schin-seng var. (3) *nepalensis* Nees, Icon. Pl. Medic. 5: t. 16 C (1833).

Aralia pseudo-Ginseng (Wall.) Benth. ex C.B. Clarke in Fl. Brit. Ind. 2: 721 (1879).

A. quinquefolia var. *pseudo-ginseng* (Wall.) Burkill in Kew Bull. 1902: 7 (1902).

? *A. quinquefolia* var. *notoginseng* et var. *elegantior* Burkill, l.c. 7 & 8 (1902).

subsp. ***pseudo-ginseng*** (Pl. X & Fig. 2, a).

Type. Nepal: mont. Sheopore, Wallich no. 3730, 1821 (K-W).

Additional specimens. C. Nepal. Shioupuri, Kathmandu, 2500 m (Ohashi, Jun. 14, 1969, fl.); Latsu—Ingyur, Gosainkund, 2240 m (Kanai & Malla, no. 673592, Aug. 21, 1969, fr.).

subsp. ***himalaicus*** Hara, subsp. nov. (Pl. XI, c-e; Pl. XII, a & Fig. 2, b).

Rhizoma longe repens, internodiis vulgo elongatis gracilibus interdum crassis, nodis subgloboso-incrassatis. Foliola elliptica vel oblonga, apice longe caudato-acuminata, margine argute duplicato-serrata, utrinque in nervis

setulosa. Bracteae inconspicuae. Pedicelli minute scabri.

Typus. Phalut, Singalila Range, 3800–3900 m (Hara, Kurosawa & Ohashi, Jul. 18, 1969 in TI).

Distr. subsp. E. Himalaya (Nepal, east to NEFA), S. E. Tibet, N. Burma, Tonkin, and West, Central & North China.

var. **angustifolius** (Burkill) Li, l. c. 118 (1942)—Hara, l. c. 227 (1966). (Pl. XII, b).

Aralia quinquefolia var. *angustifolia* Burkill, l. c. 7 (1902).

A. pseudo-ginseng var. *angustifolia* (Burkill) Craib, Fl. Siam. Enum. 1: 794 (1931).

Panax sikkimensis Banerjee, l. c. 21, f. 1 (1968).

P. assamicus Banerjee, l. c. 23, f. 2 (1968).

Distr. E. Himalaya (Nepal to Bhutan), Khasia, Manipur, Thailand, and W. China (Szechuan, Yunnan).

var. **bipinnatifidus** (Seem.) Li, l. c. 118 (1942)—Hara, l. c. 227 (1966)—Banerjee, l. c. 26 (1968). (Figs. 3 & 4).

P. bipinnatifidum Seemann in Journ. Bot. 6: 54 (1868)—P'ei et Chou, l. c. f. 278 (1958)—Hand.-Mzt., Symb. Sin. 7: 706 (1933)—Jzushritzky, l. c. 50 (1961).

Aralia bipinnatifida (Seem.) C. B. Clarke in Fl. Brit. Ind. 2: 722 (1879).

Distr. E. Himalaya (Nepal to NEFA), N. Assam, S. E. Tibet, N. Burma, and W. & C. China.

subsp. **japonicus** (Meyer) Hara, comb. nov. (Fig. 2, d).

P. quinquefolia b. *japonica* Siebold, Syn. Pl. Oecon. Jap. 45 (1830), nom. nud.

P. Schin-seng var. (2) *japonica* Nees, l. c. t. 16 B (1833).

P. japonicus C. A. Meyer. l. c. 525 (1842); l. c. 340 (1843)—Nakai in Journ. Arn. Arb. 5: 33 (1924), cum f. *typicum*, *trifoliolatum* et *dichrocarpum*—Hara, Enum. Spermat. Jap. 3: 289 (1954); Fl. E. Himal. 642 (1966)—P'ei et Chou, l. c. f. 279 (1958)—Jzushritzky, l. c. 54 (1961)—Kitamura et Murata, Col. III. Herb. Pl. Jap. 2: 33 (1961)—Ohwi, l. c. 663 (1965); l. c. 962 (1965).

P. quinquefolium δ . *subsessilis* Miquel, Ann. Mus. Bot. Lugd.-Bat. 1: 14 (1863).

P. japonicum Sieb. ex Miquel, l. c. 2: 159 (1866).

P. repens Maxim. in Bull. Acad. Sci. St.-Peters. 12: 64 (1867)—Matsu-

mura, Ind. Pl. Jap. 2(2) : 421 (1912).

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Distr. Japan (Hokkaido, south to Kyushu, Tsushima Is.), and C. & W. China.

f. *incisus* (Nakai) Hara, comb. nov.

P. japonicum f. *incisum* Nakai, l. c. 34 (1924).

Distr. W. Japan (Kinki, Shikoku).

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Distr. C. & W. Japan (the Pacific side).

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Explanations of plates

Plate X. The typical form of *Panax pseudo-ginseng* Wallich at Shiou-puri, Kathmandu, Nepal, Jun. 14, 1969. a. A flowering plant. b. Rhizomes and roots. $\times 3/5$ (photo. by H. Ohashi). c. Somatic chromosomes. $\times 1200$.

(by S. Kurosawa).

Plate XI. Rhizomes of *Panax pseudo-ginseng* var. *angustifolius*, collected at Sandakphu, the Singalila Range, Jul. 20, 1969, and subsp. *himalaicus* at the same locality, Jul. 14, 1969.

Plate XII. a. *Panax pseudoginseng* subsp. *himalaicus* at Phalut on the Singalila Range, Jul. 18, 1969. b. Var. *angustifolius* at Sandakphu on the Singalila Range, Jul. 15, 1969.

* * * *

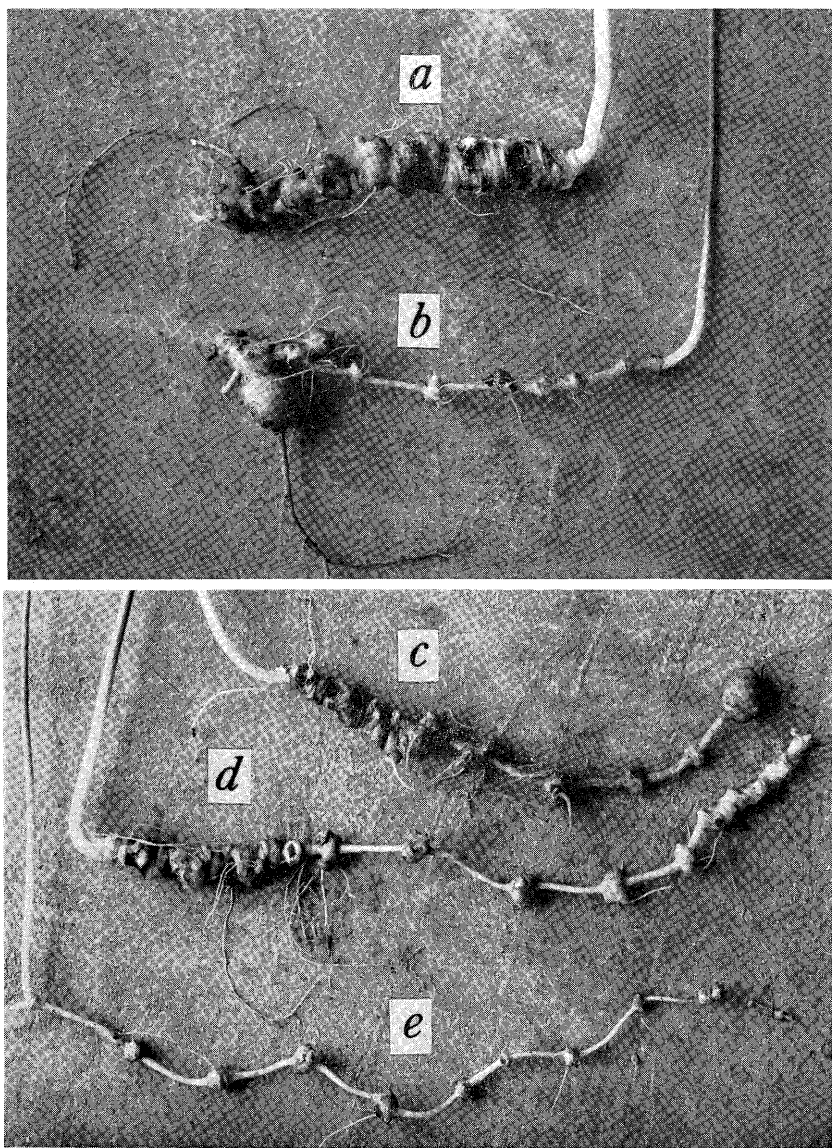
アジア産のトチパニンジン属の分類については近年も色々な見解がだされている。薬用のチョウセンニンジンとは変異が少なく、根は人参様で根茎は発達せず種子は大形で扁平され小葉は倒卵形で鋸歯は短かく毛が少なく、自生地は北朝鮮、ウスリー地方に限られており別種と認められる。私は数年間東部ヒマラヤでこの種を特に注意して観察した結果、根茎・葉形・葉の毛・花梗などにきわめて著しい変異が認められたが、一方日本産トチパニンジンにかなり似た性質をもつものも見られた。*Panax pseudo-ginseng* Wall. (1829) については 1969 年ネパールの基準産地で生品をえて観察した結果、根・種子・小葉の形ではチョウセンニンジンに近いが小葉の先は長く尾状に尖り鋸歯も尖り葉上面の脈上に長剛毛が多く花梗は長くほぼ平滑で葉柄の基に托葉状附属物があるなどの性質で異っている。一方東部ヒマラヤに普通な型は長く横臥した根茎をもち種子は小形で円味がある点でトチパニンジンに近いが、後者に比べ小葉は長く尖り鋭い鋸歯があり剛毛が多く小苞は不顕著で根茎は節間が細長くのびる傾向がある。しかしこの中のどの特徴をとってもはっきりとトチパニンジンと区別することは困難であり、また中国大陆には種々の性質の組合せをもった中間形がしばしば見られる。

トチパニンジン類では同一群落では地上部の諸性質はおおむね均一であるが、根茎の形は附図に示したように個体によりかなり変りこれは栄養その他の条件により同一個体でも年により変化することが分った。又東部ヒマラヤでは小葉が特に細長く鋸歯の細小型や、小葉が深く裂け不規則な鋸歯のある型などが目立つが中間型もあって同一地域に見られ、地方的変異として安定するに至っていない。

これらの観察結果を考慮して、ヒマラヤ・中国・日本に広く分布しているこの類は大きく一種とみなし、色々な性質で異なった傾向を示すヒマラヤと日本のものを亜種の関係におくのが妥当と思われる。この分類方式は東大生薬学教室の柴田・田中両博士等による化学成分の研究の結果ともほぼ符号する。なおネパールの *P. pseudo-ginseng* の基準型とダーズリン附近のものの染色体数は $2n=24$ であることが黒沢幸子氏により確かめられたが、更に各地からの多くの資料について再検討すべき問題点はまだ残されている。



H. HARA : Asiatic species of *Panax*



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